Area Source Methodologies

Page updated December 20, 1999

Area source methods are used to estimate emissions for approximately 260 emission source categories in the emission inventory. The ARB staff is responsible for 130 area source categories and air quality management districts are responsible for the remaining categories. The methodologies and responsible agencies are provided below.

- Index of Methodologies by Major Category
- List of Area Source Categories & Responsible Agency (.pdf)
- Off-road Mobile Source Emissions Model Development

The 260 area source emission categories, which include both stationary and other mobile sources, are divided into four types of emission sources. *Aggregated point sources* are many small point sources, or facilities, that are not inventoried individually but are estimated as a group and reported as a single source category. Examples include gas stations and dry cleaners. *Area-wide sources* include source categories associated with human activity and emissions take place over a wide geographic area. Consumer products and agricultural operations are examples of area-wide sources. *Non-anthropogenic sources* generally include source categories with naturally occurring emissions such as geogenic sources and wildfires. *Other mobile sources* include categories such as farm equipment and off-road recreational vehicles. Collectively, these types of sources are referred to as area source categories.

The ARB staff is responsible for 130 area source categories. The air pollution control and air quality management districts are responsible for the remaining categories. The Index of Methodologies by Major Category includes summaries of the methodologies with links to the complete methodologies, which are provided in Acrobat format. A detailed list of the methodologies and the CES numbers are provided in the List of Area Source Categories and the Responsible Agency in Acrobat format. The district methods may be provided in only a summary format. To calculate the emissions from *other mobile sources,* ARB staff is developing an off-road mobile source emission model, OFFROAD. Methodologies for these categories are not included here.

This web site is a living document, which means individual sections will be updated periodically as individual categories are updated or new categories are created. The methodologies are current as of July 1, 1998. If you have questions or suggestions concerning these methods please e-mail eibweb@arb.ca.gov or call (916) 322-6271.

ADMIN RECORD

Index of Methodologies by Major Category

Updated December 20, 1999

Major Categories

1. Fuel Combustion
2. Waste Disposal
3. Cleaning Coatings
4. Petroleum Production
5. Industrial Processes
6. Solvent Evaporation
7. Misc. Processes
   Dust, combustion, and other sources
8. Other Mobile Sources
9. Natural Sources

App A. Agricultural Act.

This location includes the most recent version of the area source methods manual. The area source methodologies are organized by the major categories listed to the left. Within each major category is a description of the available area source methodologies and the responsible agency. The current status of each methodology is also listed with the date of preparation. The changes highlighted in bold print are changes that have not been previously published.

Summaries of the area source methodologies and the complete text are available, including some district methodologies.

Please send questions or comments to:
eibweb@arb.ca.gov

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SECTION 7.4

AGRICULTURAL LAND PREPARATION

(Updated August 1997)

EMISSION INVENTORY SOURCE CATEGORY
Miscellaneous Processes / Farming Operations

EMISSION INVENTORY CODES (CES CODES) AND DESCRIPTION
620-614-5400-0000 (47332) Agricultural Land Preparation

METHODS AND SOURCES

The land preparation source category includes estimates of the airborne soil particulate emissions produced during the preparation of agricultural lands for planting and after harvest activities. Operations included in this methodology are discing, tilling, leveling, chiseling, plowing, and other mechanical operations used to prepare the soil. Dust emissions are produced by the mechanical disturbance of the soil by the implement used and the tractor pulling it. Soil preparation activities tend to be performed in the early spring and fall months. Table 1 shows the estimated soil preparation particulate emissions for each California county.

OVERVIEW OF ESTIMATION METHODOLOGY

Particulate emissions from land preparation operations are computed by multiplying an emission factor (EF) by an activity factor. The agricultural tilling emission factor provided in the 4th edition of U.S. EPA's AP-42 document[1] is used to estimate soil preparation emissions. The activity factor is based on the number of acres of each crop in production for each county in the State. Because different crops need different operations to prepare the soil, each crop also has its own acre-pass value. Acre-passes are the number of passes, per acre, that are typically needed to prepare a field for planting a particular crop. By combining the crop acreage, crop specific acre-pass data, and the agricultural tilling emission factor, we estimate the particulate matter produced by agricultural land preparation operations.

EMISSIONS ESTIMATION METHODOLOGY

Agricultural soil preparation particulate dust emissions are estimated *for each crop* in each county

in California using the following equation:

$$\text{Emissions}_{crop} = \text{Emission Factor} \times \text{Acres}_{crop} \times \text{Acre-passes/acre}_{crop}$$

The crop emissions for each county are summed to produce the county and statewide particulate matter (PM) and PM_{10} emission estimates. The remainder of this section discusses each component of the above equation.

Emission Factor. The emission factor used to estimate the dust emissions from agricultural land preparations is from U.S. EPA's AP-42.[1] This emission factor was developed in 1981 based on test data measured in California and Kansas by Midwest Research Institute.[2] Because of a lack of more detailed estimates, this single emission factor is used for all land preparation operations, all locations, and all seasons. The form of the emission factor is:

$$\text{Emission Factor (lbs PM/acre-pass)} = k\ (4.8)\ (s)^{0.6}$$

where 'k' is dependent on the particle size fraction of interest, and 's' is the percent soil silt content. For PM_{10} the value of 'k' used in California is 0.148. This is based on the EPA estimate that 33% of the total particulate entrained to the air during agricultural operations is 30 microns or less. Of this, analysis of California soil samples[3] indicates that about 45% of the 30 micron or less sized particles are 10 microns or less in aerodynamic size (i.e., PM_{10}). So, the California PM_{10} particle size multiplier is 0.148 (i.e., $0.33 \times 0.45 = 0.148$). For the percent soil silt value, the EPA default value of 18% soil silt is used for most counties. But, because of the large quantity of farming operations in San Joaquin Valley counties, the ARB staff analyzed soil data from the Natural Resources Conservation Service to produce county specific soil silt values for the San Joaquin Valley.

The EPA emission factor does not include an association between soil moisture and emissions. Because it is known that dust emissions are reduced when soil moisture is higher, ARB staff has incorporated an emission correction during the wettest months of the year. The correction was based on some limited agricultural dust source test data, as well as the control factor used for watering at construction sites and our best judgement. During December and March, the emission factor is reduced by 25% from the standard uncorrected value. In January and February, often the wettest months, the emission factor is reduced by 50%. This produces a seasonal emissions profile that is more consistent with actual ambient air dust levels, and also better reflects that soil preparation operations typically do not occur while the soil is excessively wet or muddy.

Acres. The acreages used for estimating soil preparation emissions are from the California Department of Food and Agriculture's (CDFA) summary of crop acreage harvested in 1993.[4] The acreage data are subdivided by county and crop type for the entire state, and are compiled from individual county agricultural commissioner reports. Complete listings of individual county crop acreages are provided in the land preparation background document.[5]

Acre-Passes & Crop Calendars. In computing land preparation PM emissions, acre-passes are the number of passes typically performed to prepare a crop for planting. These operations may occur following harvest, or closer to planting, and can include discing, tilling, land leveling, and other operations. Each crop is different in the type of soil operations performed and when they occur. To get the best estimates available, staff of the ARB met with producers of the various commodities to gather the most realistic and current information available on agricultural practices. Focusing on the largest acreage crops, we were able to gather updated information for about 90% of California's crop acreage. For the crops that were not explicitly updated, we either applied an updated crop profile from a similar crop, or used one of the existing ARB profiles. Table 2 provides a listing of the crop acre-passes used in California.

In collecting updated acre-pass data, we also collected detailed information on when agricultural operations occur. Using these data, it was possible to create detailed temporal profiles that help to indicate when PM emissions from land preparations may be highest. The more detailed background document[5] includes detailed crop calendars for each crop with updated information. For all of the acre-pass and crop calendar information, the farmers and other agricultural experts of the San Joaquin Valley were instrumental in helping us to update our crop information.

TEMPORAL ACTIVITY AND GROWTH

Temporal activity for land preparation is derived by summing, for each county, the operations that occur for each crop during each month. This is done using the crop calendar data described in the previous paragraph. Below is an example temporal profile for Fresno county. The table shows the percent of agricultural soil preparation activities that occur during each month in Fresno. Because the crops are different for each county, the profiles are different for each county. Table 3 lists the composite temporal data for each county. The activity profiles shown include the effects of the soil moisture correction, previously described in the section on the soil preparation emission factor. With these profiles, it is possible to easily compute monthly emissions estimates based on the annual total emissions provided in Table 1. Refer to Appendix A for details on how the monthly temporal profiles were developed. Growth in this category varies by county and is based on either agricultural production or crop acreage. For many counties, agricultural growth is set to zero.

CES	Hours	Days	Weeks
47332	Daylight	7	52

Fresno County

CES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
47332	2.3	4.2	5.9	1.7	4.0	4.0	5.6	6.3	4.3	12.8	28.1	20.6

ASSUMPTIONS AND LIMITATIONS

1. The current AP-42 emission factor assumes all soil preparation operations under all conditions produce the same level of emissions (assuming the percent silt is the same).

2. AP-42 estimates that 33% of the dust entrained by agricultural operations is small enough (30 microns or less) to become entrained to the air. ARB estimates that 45% of this 30 micron material is PM_{10} or less.

3. A soil silt content of 18% is used in all counties not in the San Joaquin Valley. Counties in the San Joaquin Valley use county specific values.

4. To account for increased soil moisture and reduced emissions during rainy months, baseline emissions in December and March were reduced by 25%, and January and February emissions were reduced by 50%.

5. Crop calendar data collected for San Joaquin crops and practices were extrapolated to the same crops in the remainder of the State. Existing crop profiles were used for the small percentage of crops in which update information was not collected.

CHANGES IN THE METHODOLOGY

There were significant improvements to the soil preparation emissions estimates for this update. These include:

- Incorporation of new acre-pass and crop calendar data;
- Use of updated 1993 crop acreage data from the California Department of Food and Agriculture;
- Downward adjustments to the emission estimates in the wet months, when dust emissions (on a per acre basis) tend to be less than operations on drier soil;
- Use of geographic information systems soils data to update the average percent soil silt for each county in the San Joaquin Valley. This information was used in the updated emissions calculations;
- Update of the temporal data to better reflect when agricultural activities occur during the year.

These changes produced an emissions reduction of about 53% from the previous 1993 published emission inventory estimates for agricultural soil preparation.

COMMENTS AND RECOMMENDATIONS

Studies are ongoing by the University of California, Davis, to better quantify emissions from agricultural land preparation operations. They are attempting to quantify emissions from

different types of operations on different soil for different crops during different seasons. As the UCD results become available and are approved, they will be incorporated into the emission estimation methodology. In addition, if needed, future updates could include county specific soil silt estimates for counties not in the San Joaquin Valley that still use the 18% soil silt default.

SAMPLE CALCULATIONS

The instructions and table below summarizes the data computations necessary to estimate the land preparation emissions in Merced county. The following steps are performed:

Step 1: Crop Acreage. For each crop, determine the quantity of acres harvested. The acres harvested for a few of the crops in Merced county are shown in the 'Acres' column of the table. These data are available from the county agricultural commissioner annual reports or the CDFA. The 1993 acreage data are summarized in the agricultural tilling background document.[5]

Step 2: Acre-passes per Acre. Using the data in Table 2, assign the annual acre-passes per acre used for soil preparation operations for each crop, as shown in the third column of the table.

Step 3: Compute annual acre-passes. Acre passes is the number of acres multiplied by the acre-passes per acre. *Acres x Acre-passes/acre = Acre-Passes (column 2 x column 3).*

Step 4: Insert Emission Factor. Using the soil preparation emission factor equation, compute the county emission factor. For Merced county, with an average soil silt content of 22.7%, the emission factor is 4.64 lbs PM_{10}/acre-pass. The default ARB emission factor is 4.02 lbs PM_{10}/acre-pass, based on a default soil silt of 18%.

Step 5: Compute Emissions. Multiply the annual acre-passes for each crop by the emission factor and divide by 2000 lbs/ton to get the annual PM_{10} emissions.
(Annual acre-passes x Emission Factor)/2000 = Emissions

Step 6: Compute Totals. After the dust emissions for each crop in the county are computed, sum them to compute the total county agricultural soil preparation particulate matter emissions.

Estimating Agricultural Land Preparation
PM_{10} Emissions in Merced County

Crop	Acres	Acre-Passes per Acre	Annual Acre Passes	Emission Factor (lbs PM_{10}/acre)	PM_{10} Emissions (tons/yr)
Wheat	11850	1	11850	4.64	27
Corn (silage)	45000	4	180000	4.64	418
Cotton Lint	79000	6	475200	4.64	1103
Almonds	66519	0.25	16630	4.64	39
Tomatoes (fresh)	10900	7	52010	4.64	121
etc...	...	...	...		...
Total	...	...	...		...

ADDITIONAL CODES

SOURCE CATEGORY GROWTH AND CONTROL CODES
Various

SOURCE CATEGORY CODE POLLUTANT SPECIATION PROFILES
For All: PM = 321, VOC = not applicable

SOURCE CATEGORY CODE REACTIVITY FACTORS
Not Applicable

REFERENCES

1. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, AP-42, Section 11.2.2, Fourth Edition. September 1985.

2. Muleski, Greg. The Role of Agricultural Practices in Fugitive Dust Emissions, Final Report, Appendix A. Midwest Research Institute. MRI Project No. 4809-L. Prepared for the California Air Resources Board. June 8, 1981.

3. Houck, J.E., Chow, J.C., Watson, J.G., et al. Determination of Particle Size Distribution and Chemical Composition of Particulate Matter from Selected Sources in California, Final Report. Desert Research Institute & OMNI Environmental. Prepared for California Air Resources Board. Agreement No. A6-175-32. June 30, 1989.

4. California Agricultural Statistics Service. 1993 acreage extracted from agricultural commissioner's reports. Sacramento, CA. Phone (916) 654-1533.

5. Gaffney, P.H., Agricultural Land Preparation: Geologic Particulate Matter Emission Estimates, Background Document. California Air Resources Board. September 1997.

6. SJVAQS / AUSPEX Agricultural Emissions Inventory, Appendix B. Sierra Research Incorporated. Contact: Phil Heirigs. Prepared for the San Joaquin Valley wide Air Pollution Study Agency. Report No. SR93-04-01. April 5, 1993.

UPDATED BY

Patrick Gaffney
August 1997

TABLE 1
1993 Agricultural Land Preparation PM_{10} and TSP Emissions
EIC: 620-614-5400-0000; CES: 47332; Activity: Acre-Passes

Air Basin	ARB County ID #	County	Annual Soil Prep. Acre Passes	Annual County PM_{10} Emissions (tons/year)	Annual County TSP Emissions (tons/year)
GBV	2	ALPINE	0	0.0	0.0
	14	INYO	8424	17.0	37.8
	26	MONO	20361	41.1	91.3
LC	17	LAKE	19742	39.9	88.6
LT	9	EL DORADO	294	0.6	1.3
	31	PLACER	9335	18.8	41.9
MC	3	AMADOR	9002	18.2	40.4
	5	CALAVERAS	1624	3.3	7.3
	9	EL DORADO	2152	4.3	9.7
	22	MARIPOSA	3603	7.3	16.2
	29	NEVADA	181	0.4	0.8
	31	PLACER	56942	115.0	255.5
	32	PLUMAS	19606	39.6	88.0
	46	SIERRA	7620	15.4	34.2
	55	TUOLUMNE	310	0.6	1.4
NC	8	DEL NORTE	2205	4.5	9.9
	12	HUMBOLDT	4335	8.8	19.5
	23	MENDOCINO	14415	29.1	64.7
	53	TRINITY	750	1.5	3.4
	49	SONOMA	56547	114.2	253.7
NCC	27	MONTEREY	1357993	2741.6	6092.4
	35	SAN BENITO	152663	308.2	684.9
	44	SANTA CRUZ	73056	147.5	327.8
NEP	18	LASSEN	121984	246.3	547.3
	25	MODOC	179015	361.4	803.1
	47	SISKIYOU	204428	412.7	917.1
SC	19	LOS ANGELES	13322	26.9	59.8
	30	ORANGE	57000	115.1	255.7
	33	RIVERSIDE	156076	315.1	700.2
	36	SAN BERNARDINO	55674	112.4	249.8
SCC	40	SAN LUIS OBISPO	300932	607.5	1350.1
	42	SANTA BARBARA	389660	786.7	1748.1
	56	VENTURA	286388	578.2	1284.8
SD	37	SAN DIEGO	76984	155.4	345.4
SED	13	IMPERIAL	1340783	2706.8	6015.2
	15	KERN	915564	2135.6	4745.9
	19	LOS ANGELES	19983	40.3	89.7
	33	RIVERSIDE	254650	514.1	1142.4
	36	SAN BERNARDINO	22740	45.9	102.0
SF	1	ALAMEDA	19944	40.3	89.5
	7	CONTRA COSTA	98409	198.7	441.5
	21	MARIN	4090	8.3	18.3
	28	NAPA	35727	72.1	160.3
	38	SAN FRANCISCO	25	0.1	0.1
	41	SAN MATEO	18546	37.4	83.2
	43	SANTA CLARA	99450	200.8	446.2
	48	SOLANO	115930	234.0	520.1
	49	SONOMA	36153	73.0	162.2
SJV	10	FRESNO	4749452	10275.2	22833.9
	15	KERN	1945573	4538.2	10085.0
	16	KINGS	2245961	5211.4	11580.9
	20	MADERA	664092	1569.3	3487.2
	24	MERCED	1352048	3137.2	6971.6
	39	SAN JOAQUIN	1358986	3170.0	7044.4
	50	STANISLAUS	807830	2042.9	4539.7
	54	TULARE	1857448	4148.4	9218.7
SV	4	BUTTE	570608	1152.0	2559.9
	6	COLUSA	1112637	2246.2	4991.6
	11	GLENN	694569	1402.2	3116.0
	31	PLACER	27071	54.7	121.4
	34	SACRAMENTO	403602	814.8	1810.7
	45	SHASTA	49929	100.8	224.0
	48	SOLANO	463719	936.2	2080.4
	51	SUTTER	842398	1700.7	3779.3
	52	TEHEMA	54301	109.6	243.6
	57	YOLO	1215239	2453.4	5451.9
	58	YUBA	203935	411.7	914.9
		Statewide Total	**27264019**	**59176.5**	**131503.3**

Fraction of PM_{10} = 0.45 (PM_{10} Emissions = TSP x 0.45)

TABLE 2
Summary of Crop Acre-Passes

CDFA Crop Code	Acre Passes[1]	CDFA Commodity Description	Crop Profile Used[2]	Percent Prepared Yearly[3]
101999	1	WHEAT ALL	Wheat/Barley	100
104999	1	RYE FOR GRAIN	Wheat/Barley	100
106199	5	RICE, FOR MILLING	Rice	100
106269	0	FIELD CROP BY PRODUCTS	No Land Prep.	0
108999	4	FOOD GRAINS, MISC	Field Corn	100
111559	4	CORN, WHITE	Field Corn	100
111991	4	CORN FOR GRAIN	Field Corn	100
111992	4	CORN FOR SILAGE	Field Corn	100
111998	4	CORN, CRAZY	Field Corn	100
112999	1	OATS FOR GRAIN	Wheat/Barley	100
113994	1	BARLEY, MALTING	Wheat/Barley	100
113995	1	BARLEY, FEED	Wheat/Barley	100
113999	1	BARLEY, UNSPECIFIED	Wheat/Barley	100
114991	1	SORGHUM, GRAIN	Wheat/Barley	100
114992	1	SORGHUM, SILAGE	Wheat/Barley	100
121219	6	COTTON LINT, UPLAND	Cotton	100
121229	6	COTTON LINT, PIMA	Cotton	100
121299	6	COTTON LINT, UNSPEC	Cotton	100
131999	6	SUGARCANE	Corn / KVB	100
132999	5	SUGARBEETS	Sugarbeets	100
151999	6	COTTONSEED	Cotton	100
153999	6	PEANUTS, ALL	Soybean / KVB	100
154999	6	SOYBEANS	Soybean / KVB	100
158269	2	SAFFLOWER	Safflower	100
158279	3	SESAME	Sesame / KVB	100
158316	5	SUNFLOWER SEED, PLANTING	Sunflower / Sierra	100
158319	5	SUNFLOWER SEED	Sunflower/ Sierra	100
158499	3	JOJOBA	Estimated	100
158999	3	SEEDS MISC OIL, UNSPEC.	Estimated	100
161131	5	BEANS, LIMAS, LG. DRY	Dry Beans	100
161132	5	BEANS, LIMAS, BABY DRY	Dry Beans	100
161199	5	LIMA BEANS, UNSPECIFIED	Dry Beans	100
161713	5	BEANS, SM WHITE	Dry Beans	100
161714	5	BEANS, FLAT SM WHITE	Dry Beans	100
161716	5	BEANS, PINTO	Dry Beans	100
161717	5	BEANS, RED KIDNEY	Dry Beans	100
161721	5	BEANS, PINK	Dry Beans	100
161722	5	BEANS, SM RED	Dry Beans	100
161741	5	BEANS, BLACKEYE (PEAS)	Dry Beans	100
161742	5	BEANS, GARBANZO	Garbanzo	100
162399	5	BEANS, FAVA	Dry Beans	100
163999	5	PEAS, DRY EDIBLE	Dry Beans	100
169999	5	BEANS,UNSPEC. DRY EDIBLE	Dry Beans	100
171019	1	SEED WHEAT	Wheat/Barley	100
171049	1	SEED RYE	Wheat/Barley	100
171069	5	SEED RICE	Rice	100
171119	4	SEED CORN	Field Corn	100
171129	1	SEED OATS	Wheat/Barley	100
171139	1	SEED BARLEY	Wheat/Barley	100
171149	1	SEED SORGHUM	Wheat/Barley	100
171519	6	SEED, COTTON FOR PLANTING	Cotton	100
171582	2	SEED, SAFFLOWER, PLANTING	Safflower	100
171619	5	SEED BEANS	Dry Beans	100
171639	5	SEED PEAS	Dry Beans	100
171929	4	SEED POPCORN	Field Corn	100
171949	4	SEED, MISC FIELD CROP	Field Corn	100
171959	5	SEED, VEG & VINECROP	Veg./Sierra Research	100
172119	1.25	SEED, ALFALFA	Alfalfa (hay)	20
172232	1.25	CLOVER, STRAWBERRY, SEED	Alfalfa (hay)	20
172269	1.25	CLOVER, LADINO SEED	Alfalfa (hay)	20
172289	1.25	CLOVER, UNSPECIFIED SEED	Alfalfa (hay)	20
172899	1.25	CLOVER, OTHER, SEED	Alfalfa (hay)	20
172909	1.25	SEEDS, ALL OTHER LEGUMES	Alfalfa (hay)	20
173079	1.25	SEED, BERMUDA GRASS	Alfalfa (hay)	20
173123	1.25	SEED, BLUEGRASS	Alfalfa (hay)	20
173259	1.25	SEED, BROMEGRASS	Alfalfa (hay)	20
173669	1.25	SEED, SUDAN GRASS	Alfalfa (hay)	20
173999	1.25	SEED, GRASS, UNSPECIFIED	Alfalfa (hay)	20
174412	1.25	RYEGRASS, PERENNIAL, ALL	Alfalfa (hay)	20
174413	1.25	RYEGRASS,PERENNIAL,PROP.	Alfalfa (hay)	20
174414	1.25	RYEGRASS, OTHER PERENNIAL	Alfalfa (hay)	20
174699	1.25	SEED, VETCH	Alfalfa (hay)	20
178999	1.25	SEED, OTHER (NO FLOWERS)	Alfalfa (hay)	20
181999	1.25	HAY, ALFALFA	Alfalfa (hay)	20
188499	1.25	HAY, GRAIN	Alfalfa (hay)	20
188799	1.25	HAY, WILD	Alfalfa (hay)	20

TABLE 2 (continued)
Summary of Crop Acre-Passes

CDFA Crop Code	Acre Passes[1]	CDFA Commodity Description	Crop Profile Used[2]	Percent Prepared Yearly[3]
188899	1.25	HAY, SUDAN	Alfalfa (hay)	20
188999	1.25	HAY, OTHER UNSPECIFIED	Alfalfa (hay)	20
194599	0	PASTURE, IRRIGATED	No Land Prep.	0
194699	0	PASTURE, RANGE	No Land Prep.	0
194799	0	PASTURE, MISC. FORAGE	No Land Prep.	0
195199	1	SILAGE	Wheat/Barley	100
195299	1.25	HAY, GREEN CHOP	Alfalfa (hay)	20
195399	1.25	STRAW	Alfalfa (hay)	20
198199	5	RICE, WILD	Rice	100
198299	3	GUAR	Artichoke / Sierra	100
198399	3	YUCCA	Artichoke / Sierra	100
198499	3	JERUSALEM ARTICHOKES	Artichoke / Sierra	100
198599	3	YUCCA AND GUYULE	Artichoke / Sierra	100
198999	4	FIELD CROPS, UNSPEC.	Field Corn	100
201119	0.06	ORANGES, NAVEL	Citrus	5
201519	0.06	ORANGES, VALENCIAS	Citrus	5
201999	0.06	ORANGES, UNSPECIFIED	Citrus	5
202999	0.06	GRAPEFRUIT, ALL	Citrus	5
203999	0.06	TANGERINES & MANDARINS	Citrus	5
204999	0.06	LEMONS, ALL	Citrus	5
205999	0.06	LIMES, ALL	Citrus	5
206999	0.06	TANGELOS	Citrus	5
207999	0.06	KUMQUATS	Citrus	5
208059	0.06	CITRUS, MISC BY-PROD	Citrus	5
209999	0.06	CITRUS, UNSPECIFIED	Citrus	5
211999	0.06	APPLES, ALL	Citrus	5
212199	0.06	PEACHES, FREESTONE	Citrus	5
212399	0.06	PEACHES, CLINGSTONE	Citrus	5
212999	0.06	PEACHES, UNSPECIFIED	Citrus	5
213199	0.06	CHERRIES, SWEET	Citrus	5
214199	0.06	PEARS, BARLETT	Citrus	5
214899	0.06	PEARS, ASIAN	Citrus	5
214999	0.06	PEARS, UNSPECIFIED	Citrus	5
215199	0.06	PLUMS	Citrus	5
215999	0.06	PRUNES, DRIED	Citrus	5
216199	0.55	GRAPES, TABLE	Grapes-Table	5
216299	1.02	GRAPES, WINE	Grapes-Wine	5
216399	2.27	GRAPES, RAISIN	Grapes-Raisin	5
216999	1.02	GRAPES, UNSPECIFIED	Grapes-Wine	5
217999	0.06	APRICOTS, ALL	Citrus	5
218199	0.06	NECTARINES	Citrus	5
218299	0.06	PERSIMMONS	Citrus	5
218399	0.06	POMEGRANATES	Citrus	5
218499	0.06	QUINCE	Citrus	5
218819	0.06	CACTUS, FRUITS	Citrus	5
218829	0.06	CAROBS	Citrus	5
218839	0.06	CHERIMOYAS	Citrus	5
218889	0	ORCHARD BIOMASS	No Land Prep.	0
218899	0.06	FRUITS & NUTS, UNSPEC.	Citrus	5
221999	0.06	AVOCADOS, ALL	Citrus	5
224999	0.06	DATES	Citrus	5
225999	0.06	FIGS, DRIED	Citrus	5
226999	0.06	OLIVES	Citrus	5
228019	0.06	GUAVAS	Citrus	5
228029	0.06	FEIJOA	Citrus	5
229999	0.06	KIWIFRUIT	Citrus	15
230639	0.9	BERRIES, BLACKBERRIES	Vine Crops / KVB	15
230869	0.9	BERRIES, BOYSENBERRIES	Vine Crops / KVB	15
234799	0.9	BERRIES, LOGANBERRIES	Vine Crops / KVB	15
235799	0.9	BERRIES, OLALLIEBERRIES	Vine Crops / KVB	15
236199	6	BERRIES, RASPBERRIES	Vine Crops / KVB	100
237199	6	STRAWBERRIES, FRESH MKT	Strawberries / KVB	100
237299	6	STRAWBERRIES, PROC	Strawberries / KVB	100
237999	6	STRAWBERRIES, UNSPECIFIED	Strawberries / KVB	100
239999	0.9	BERRIES, BUSH, UNSPECIFIED	Vine Crops / KVB	15
261999	0.25	ALMONDS, ALL	Almond/Walnut	5
262999	0.25	FILBERTS	Almond/Walnut	5
263999	0.25	WALNUTS, ENGLISH	Almond/Walnut	5
264999	0.25	PECANS	Almond/Walnut	5
265999	0.25	WALNUTS, BLACK	Almond/Walnut	5
266999	0.25	CHESTNUTS	Almond/Walnut	5
267999	0.25	MACADAMIA NUT	Almond/Walnut	5
268079	0.25	PISTACHIOS	Almond/Walnut	5
268089	0.25	TUNG NUTS	Almond/Walnut	5
268099	0	ALMOND HULLS	No Land Prep.	0
299999	0.25	FRUIT & NUTS, ALL	Almond/Walnut	5

TABLE 2 (continued)
Summary of Crop Acre-Passes

CDFA Crop Code	Acre Passes[1]	CDFA Commodity Description	Crop Profile Used[2]	Percent Prepared Yearly[3]
301999	3	ARTICHOKES	Artichoke / Sierra R.	100
302199	2	ASPARAGUS, FRESH MKT	Asparagus / KVB	100
302299	2	ASPARAGUS, PROC	Asparagus / KVB	100
302999	2	ASPARAGUS, UNSPECIFIED	Asparagus / KVB	100
303999	5	BEANS, GREEN LIMAS	Dry Beans	100
304199	5	BEANS, SNAP FR MKT	Dry Beans	100
304299	5	BEANS, SNAP PROC	Dry Beans	100
307189	5	BROCCOLI,FOOD SERV	Veg./Sierra	100
307199	5	BROCCOLI, FR MKT	Veg./Sierra Research	100
307299	5	BROCCOLI, PROC	Veg./Sierra Research	100
307919	5	BROCCOLI, UNSPECIFIED	Veg./Sierra Research	100
308999	3	BRUSSELS SPROUTS	Artichoke / Sierra R.	100
309999	4.5	CABBAGE, CH. & SPECIALTY	Lettuce/ 1 season	100
310191	4.5	CABBAGE, WINTER	Lettuce/ 1 season	100
310193	4.5	CABBAGE, SPRING	Lettuce/ 1 season	100
310195	4.5	CABBAGE, SUMMER	Lettuce/ 1 season	100
310197	4.5	CABBAGE, FALL	Lettuce/ 1 season	100
310199	4.5	CABBAGE, FR. MARKET	Lettuce/ 1 season	100
310992	4.5	CABBAGE, RED	Lettuce/ 1 season	100
310999	4.5	CABBAGE, HEAD	Lettuce/ 1 season	100
312999	4.5	CARDOON	Lettuce/ 1 season	100
313189	5	CARROTS, FOOD SERV	Sugarbeets	100
313199	5	CARROTS, FR MKT	Sugarbeets	100
313299	5	CARROTS, PROC	Sugarbeets	100
313999	5	CARROTS, UNSPECIFIED	Sugarbeets	100
314189	5	CAULIFLOWER, FOOD SERV	Veg./Sierra Research	100
314199	5	CAULIFLOWER, FR MKT	Veg./Sierra Research	100
314299	5	CAULIFLOWER, PROC	Veg./Sierra Research	100
314999	5	CAULIFLOWER, UNSPECIFIED	Veg./Sierra Research	100
316189	4.5	CELERY, FOOD SERV	Lettuce/ 1 season	100
316199	4.5	CELERY, FR MKT	Lettuce/ 1 season	100
316299	4.5	CELERY, PROC	Lettuce/ 1 season	100
316999	4.5	CELERY, UNSPECIFIED	Lettuce/ 1 season	100
318999	4.5	RADICCHIO	Lettuce/ 1 season	100
320999	4.5	CHIVES	Lettuce/ 1 season	100
322999	4.5	COLLARD GREENS	Lettuce/ 1 season	100
323999	4	CORN, SWEET ALL	Field Corn	100
325999	5	CUCUMBERS	Veg./Sierra Research	100
330999	5	EGGPLANT, ALL	Veg./Sierra Research	100
331999	4.5	ENDIVE, ALL	Lettuce/ 1 season	100
332999	4.5	ESCAROLE, ALL	Lettuce/ 1 season	100
333999	4.5	ANISE (FENNEL)	Lettuce/ 1 season	100
335999	4	GARLIC, ALL	Garlic	100
337999	4.5	KALE	Lettuce/ 1 season	100
338999	4.5	KOHLRABI	Lettuce/ 1 season	100
339192	4.5	LETTUCE, NAKED PACK	Lettuce/ 1 season	100
339194	4.5	LETTUCE, WRAPPED PACK	Lettuce/ 1 season	100
339196	4.5	LETTUCE, BULK SALAD PRODS.	Lettuce/ 1 season	100
339999	4.5	LETTUCE, UNSPECIFIED	Lettuce/ 1 season	100
340999	4.5	LETTUCE, HEAD	Lettuce/ 1 season	100
341999	4.5	LETTUCE, ROMAINE	Lettuce/ 1 season	100
342999	4.5	LETTUCE, LEAF	Lettuce/ 1 season	100
343999	4	MELON, CANTALOUPE	Melon	100
344999	4	MELON, CASABA	Melon	100
346999	4	MELON, CRENSHAW	Melon	100
348999	4	MELON, HONEYDEW	Melon	100
354299	4	MELON, UNSPECIFIED	Melon	100
354999	4	MELON, WATER MELONS	Melon	100
355999	1	MUSHROOMS	No Land Prep.	100
356999	4.5	MUSTARD	Lettuce/ 1 season	100
357999	4.5	OKRA	Lettuce/ 1 season	100
358999	5	ONIONS	Onions	100
359999	4.5	PARSLEY	Lettuce/ 1 season	100
360999	4.5	PARSNIPS	Lettuce/ 1 season	100
361199	5	PEAS, GREEN, FR. MKT.	Dry Beans	100
361299	5	PEAS, GREEN, PROCESSING	Dry Beans	100
361999	5	PEAS, GREEN, UNSPECIFIED	Dry Beans	100
362999	5	PEAS, COWPEA & BLACKEYE	Dry Beans	100
363999	7	PEPPERS, BELL	Tomatoes	100
364999	7	PEPPERS, CHILI, HOT	Tomatoes	100
365999	7	PIMENTOS	Tomatoes	100
366999	4	PUMPKINS	Melon	100
367999	5	RADISHES	Sugarbeets	100
368999	4.5	RHUBARB	Lettuce/ 1 season	100
370999	5	RUTABAGAS	Sugarbeets	100
372999	5	ONIONS, GREEN & SHALLOTS	Onions	100

TABLE 2 (continued)
Summary of Crop Acre-Passes

CDFA Crop Code	Acre Passes[1]	CDFA Commodity Description	Crop Profile Used[2]	Percent Prepared Yearly[3]
374189	4.5	SPINACH, FOOD SERV	Lettuce/ 1 season	100
374199	4.5	SPINACH, FR MKT	Lettuce/ 1 season	100
374299	4.5	SPINACH, PROC	Lettuce/ 1 season	100
374999	4.5	SPINACH UNSPECIFIED	Lettuce/ 1 season	100
375999	4	SQUASH	Melon	100
376999	4.5	SWISSCHARD	Lettuce/ 1 season	100
377999	5	TARO ROOT	Sugarbeets	100
378199	7	TOMATOES, FRESH MARKET	Tomatoes	100
378299	7	TOMATOES, PROCESSING	Tomatoes	100
378999	7	TOMATOES, UNSPECIFIED	Tomatoes	100
380999	5	TURNIPS, ALL	Sugarbeets	100
381999	4.5	GREENS, TURNIP & MUSTARD	Lettuce/ 1 season	100
392999	5	SWEET POTATOES	Sugarbeets	100
393999	5	HORSERADISH	Onions	100
394199	4.5	SALAD GREENS NEC	Lettuce/ 1 season	100
394999	5	PEAS, EDIBLE POD (SNOW)	Dry Beans	100
395999	5	VEGETABLES, ORIENTAL, ALL	Veg./Sierra Research	100
396999	1	SPROUTS, ALFALFA & BEAN	Lettuce/ 1 season	100
397999	7	CHAYOTES	Tomatoes	100
398199	0	CUCUMBERS, GREENHOUSE	No Land Prep.	100
398299	0	TOMATOES, GREENHOUSE	No Land Prep.	100
398399	7	TOMATOES, CHERRY	Tomatoes	100
398499	7	TOMATILLO	Tomatoes	100
398599	4.5	SPICES AND HERBS	Lettuce/ 1 season	100
398899	5	VEGETABLES, BABY	Veg./Sierra Research	100
398999	5	VEGETABLES, UNSPECIFIED	Veg./Sierra Research	100
none	0.25	GENERAL LAND MAINTENANCE	Land Maintenance	25
399999	0	VEGETABLES, GREENHOUSE	No Land Prep.	100

(1) The computed Acre-Pass values were used to compute the soil preparation dust emissions. Acre-passes are based on either:

1) Updated crop calendars that the ARB developed in cooperation with agricultural experts during the summer of 1997, with addition crop assignments to similar crops by ARB staff. The full crop calendars are provided in reference 5, the soil preparation background document.
2) Acre-pass data compiled by Sierra Research in reference 6.
3) Acre-pass data compiled by KVB and included in the MRI report listed in reference 2. This is the ARB's historical default data.

The acre-passes listed incorporate the percentage of harvested acreage that is tilled for each crop each year. No further adjustment is necessary. See (3) below for more information.

(2) This column describes the source of the acre-pass data used for each crop. Most assignments are based on item 1 above. Those notated as Sierra or KVB are based on items 2, or 3, respectively, listed above.

(3) For each crop listed, this column indicates the percentage of land on which soil preparation is performed each year. For example, alfalfa is typically planted only once every four years, so 25% is listed in the column. This means that on average, only 25% of the total acreage is undergoing land preparation operations each year. During land preparation for alfalfa planting, 5 operations are generally performed, so 1.25 acre-passes (i.e., 25% x 5) are performed annually for each harvested acre of alfalfa.

TABLE 3
Seasonal Profile for Soil Preparation Emissions*

Basin	ID#	County	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
GBV	2	ALPINE	0.003	0.001	0.001	0.001	0.007	0.007	0.027	0.017	0.299	0.619	0.012	0.009
	14	INYO	0.006	0.000	0.000	0.002	0.002	0.005	0.005	0.003	0.277	0.591	0.062	0.046
	26	MONO	0.010	0.000	0.002	0.009	0.009	0.022	0.027	0.023	0.225	0.488	0.112	0.073
LC	17	LAKE	0.017	0.003	0.004	0.003	0.025	0.025	0.029	0.062	0.179	0.416	0.140	0.097
LT	9	EL DORADO	0.001	0.000	0.000	0.001	0.007	0.007	0.027	0.017	0.300	0.621	0.012	0.007
	31	PLACER	0.002	0.000	0.124	0.166	0.166	0.166	0.000	0.001	0.097	0.201	0.045	0.033
MC	3	AMADOR	0.023	0.000	0.015	0.001	0.022	0.022	0.022	0.054	0.237	0.493	0.064	0.048
	5	CALAVERAS	0.002	0.000	0.001	0.000	0.001	0.001	0.001	0.004	0.326	0.652	0.006	0.004
	9	EL DORADO	0.001	0.000	0.000	0.001	0.007	0.007	0.027	0.017	0.300	0.621	0.012	0.007
	22	MARIPOSA	0.010	0.000	0.009	0.000	0.000	0.000	0.000	0.001	0.322	0.644	0.008	0.006
	29	NEVADA	0.001	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.326	0.654	0.000	0.000
	31	PLACER	0.002	0.000	0.124	0.166	0.166	0.166	0.000	0.001	0.097	0.201	0.045	0.033
	32	PLUMAS	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.263	0.564	0.095	0.071
	46	SIERRA	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.273	0.563	0.092	0.069
	55	TUOLUMNE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.330	0.662	0.004	0.003
NC	8	DEL NORTE	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.245	0.554	0.109	0.081
	12	HUMBOLDT	0.002	0.000	0.001	0.008	0.007	0.007	0.007	0.000	0.310	0.633	0.014	0.010
	23	MENDOCINO	0.006	0.000	0.000	0.002	0.030	0.030	0.046	0.076	0.261	0.547	0.002	0.000
	53	TRINITY	0.019	0.000	0.007	0.003	0.082	0.082	0.085	0.145	0.105	0.258	0.124	0.091
	49	SONOMA	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.313	0.631	0.031	0.024
NCC	27	MONTEREY	0.007	0.006	0.013	0.012	0.008	0.007	0.419	0.097	0.034	0.360	0.022	0.014
	35	SAN BENITO	0.012	0.008	0.019	0.020	0.023	0.025	0.191	0.026	0.100	0.377	0.113	0.085
	44	SANTA CRUZ	0.008	0.000	0.019	0.024	0.008	0.009	0.200	0.058	0.107	0.350	0.127	0.091
NEP	18	LASSEN	0.001	0.001	0.004	0.010	0.001	0.001	0.421	0.087	0.040	0.382	0.044	0.007
	25	MODOC	0.026	0.003	0.004	0.005	0.005	0.005	0.000	0.003	0.116	0.358	0.269	0.205
	47	SISKIYOU	0.023	0.010	0.003	0.034	0.030	0.030	0.049	0.010	0.109	0.329	0.206	0.166
SC	19	LOS ANGELES	0.017	0.002	0.000	0.032	0.032	0.032	0.000	0.002	0.135	0.351	0.226	0.172
	30	ORANGE	0.027	0.000	0.022	0.003	0.000	0.003	0.042	0.028	0.202	0.447	0.132	0.094
	33	RIVERSIDE	0.009	0.024	0.123	0.127	0.047	0.012	0.203	0.037	0.068	0.282	0.063	0.006
	36	SAN BERNARDINO	0.016	0.017	0.058	0.050	0.073	0.077	0.105	0.046	0.017	0.128	0.238	0.176
SCC	40	SAN LUIS OBISPO	0.007	0.000	0.006	0.002	0.028	0.028	0.026	0.004	0.274	0.582	0.025	0.018
	42	SANTA BARBARA	0.003	0.005	0.016	0.035	0.030	0.010	0.341	0.121	0.068	0.313	0.040	0.020
	56	VENTURA	0.014	0.008	0.022	0.036	0.020	0.004	0.353	0.045	0.044	0.388	0.040	0.026
SD	37	SAN DIEGO	0.023	0.025	0.088	0.103	0.064	0.026	0.070	0.025	0.093	0.240	0.170	0.071
SED	13	IMPERIAL	0.038	0.021	0.039	0.026	0.103	0.107	0.121	0.023	0.026	0.182	0.169	0.146
	15	KERN	0.008	0.038	0.058	0.015	0.019	0.027	0.040	0.035	0.042	0.110	0.349	0.259
	19	LOS ANGELES	0.027	0.000	0.022	0.003	0.000	0.003	0.042	0.028	0.202	0.447	0.132	0.094
	33	RIVERSIDE	0.016	0.017	0.058	0.050	0.073	0.077	0.105	0.046	0.017	0.128	0.238	0.176
	36	SAN BERNARDINO	0.007	0.000	0.006	0.002	0.028	0.028	0.026	0.004	0.274	0.582	0.025	0.018
SF	1	ALAMEDA	0.015	0.000	0.010	0.000	0.011	0.011	0.036	0.027	0.192	0.425	0.156	0.117
	7	CONTRA COSTA	0.086	0.024	0.072	0.034	0.008	0.022	0.027	0.009	0.094	0.277	0.202	0.146
	21	MARIN	0.004	0.000	0.000	0.000	0.000	0.000	0.025	0.000	0.273	0.592	0.060	0.045
	28	NAPA	0.027	0.000	0.000	0.005	0.130	0.130	0.130	0.326	0.056	0.171	0.013	0.010
	38	SAN FRANCISCO	0.000	0.000	0.000	0.000	0.000	0.000	0.500	0.000	0.000	0.500	0.000	0.000
	41	SAN MATEO	0.003	0.008	0.080	0.108	0.030	0.001	0.154	0.067	0.085	0.202	0.158	0.104
	43	SANTA CLARA	0.019	0.012	0.071	0.090	0.023	0.014	0.133	0.027	0.089	0.312	0.123	0.086
	48	SOLANO	0.088	0.066	0.047	0.013	0.011	0.003	0.020	0.003	0.032	0.177	0.293	0.247
	49	SONOMA	0.019	0.000	0.007	0.003	0.082	0.082	0.085	0.145	0.105	0.258	0.124	0.091
SJV	10	FRESNO	0.023	0.042	0.059	0.017	0.040	0.040	0.058	0.063	0.043	0.128	0.281	0.206
	15	KERN	0.008	0.038	0.058	0.015	0.019	0.027	0.040	0.035	0.042	0.110	0.349	0.259
	16	KINGS	0.028	0.050	0.083	0.001	0.002	0.002	0.013	0.003	0.006	0.049	0.436	0.327
	20	MADERA	0.027	0.024	0.049	0.002	0.047	0.047	0.083	0.104	0.053	0.140	0.243	0.180
	24	MERCED	0.046	0.037	0.083	0.039	0.041	0.029	0.017	0.010	0.034	0.121	0.311	0.233
	39	SAN JOAQUIN	0.092	0.052	0.113	0.053	0.050	0.029	0.038	0.044	0.023	0.130	0.212	0.163
	50	STANISLAUS	0.059	0.031	0.098	0.126	0.108	0.020	0.028	0.029	0.043	0.140	0.183	0.136
	54	TULARE	0.047	0.032	0.082	0.001	0.019	0.019	0.042	0.043	0.030	0.091	0.341	0.253
SV	4	BUTTE	0.013	0.007	0.175	0.214	0.214	0.214	0.010	0.002	0.030	0.066	0.032	0.023
	6	COLUSA	0.019	0.021	0.161	0.199	0.179	0.164	0.013	0.000	0.015	0.075	0.088	0.065
	11	GLENN	0.033	0.014	0.164	0.177	0.178	0.176	0.000	0.000	0.027	0.060	0.095	0.076
	31	PLACER	0.002	0.000	0.124	0.166	0.166	0.166	0.000	0.001	0.097	0.201	0.045	0.033
	34	SACRAMENTO	0.110	0.027	0.105	0.050	0.063	0.063	0.014	0.018	0.030	0.140	0.209	0.169
	45	SHASTA	0.014	0.000	0.014	0.018	0.018	0.018	0.000	0.000	0.203	0.481	0.134	0.100
	48	SOLANO	0.088	0.066	0.047	0.013	0.011	0.003	0.020	0.003	0.032	0.177	0.293	0.247
	51	SUTTER	0.033	0.029	0.147	0.178	0.171	0.154	0.004	0.000	0.011	0.081	0.107	0.083
	52	TEHEMA	0.012	0.006	0.023	0.014	0.013	0.013	0.001	0.000	0.252	0.510	0.092	0.064
	57	YOLO	0.111	0.050	0.080	0.041	0.042	0.035	0.008	0.002	0.010	0.173	0.251	0.197
	58	YUBA	0.010	0.001	0.169	0.214	0.214	0.214	0.001	0.001	0.047	0.094	0.023	0.014

* The seasonal emissions profiles shown include the effects of the ARB's soil moisture correction factor for the months of December, January, and February, and March. For profiles that show only the soil preparation activities, without the emissions adjustment, contact the ARB.

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